Benefits Flow and Utilization of Kipkunur Forest Products by Upstream and Downstream Users, Elgeyo Marakwet County, Kenya

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Benefits Flow and Utilization of Kipkunur Forest Products by Upstream and Downstream Users, Elgeyo Marakwet County, Kenya

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Abstract: Utilization of forests resources among economic units has remained partially noticed, yet, communities living adjacent to the forests and beyond are dependent directly or indirectly for their livelihood. Unaccounted benefit flow of a resource, leads to inappropriate policy formulation that undermines sustainability of such resource(s). Therefore, this study sought (i) to identify consumptive forests products by economic units, (ii) to estimate benefits flow of forests among economic units and (iii) to test relationship of socio economic variables that are associated with forest resource consumption among economic units. Two structured questionnaires were designed for upstream and downstream study areas. Systematic random sampling was used in administering 221 questionnaires for upstream and 231 for downstream respondents. Excel and Statistical Package for Social Sciences version-20 were used in analysing descriptive statistics. From the results, adjacent communities to the forest were found to derive more forest benefits than downstream study area. Identified forest products that were highly dependent by upstream forest users are water, fuel wood, wild fruits, wild vegetables, mushroom, pastures, herbs and honey, while for downstream users are water supply, honey and herbs. Again, results showed variation in consumption of forests commodities; where upstream were found to derive more benefits than downstream households. Further, climatic variation in terms of spatial and temporal scale, households' demographic and socio economic characteristics were found to influence consumptiveness of forests resources. In conclusion, there exist variation in benefits derivation among in-situ and ex-situ consumers, which highlights the significance of formulating a paradigm conservation policy that reflects Kaldor-Hicks efficiency criterion. Presence of variables that was hard to interpret and/or those that remained untruly explained from the relationship tests, which formed part of limitation of this study, form the basis for further investigation.

Keywords: Consumptiveness, Forest Products, Economic Units, Climatic Variation

1. Introduction

Over the years, forests provisions and regulative services are believed to be consumed in-situ, however, its characteristics as trans-boundary makes such resources to be consumed by societies living far and beyond (Angelsen et al., 2014). For example, (Agrawal, A.C., 2013) found forests to directly provide subsistence and income streams to about 350 million people in the rural homes living adjacent to the forest. (Fisher, 2004) found that about 35% of total income for rural households that live adjacent to forests in Malawi comes from the forest. (Levang et al. 2015) found forests to benefits households living adjacent by providing subsistence from hunting and gathering of forest resources such as herbs, fuel wood and wild fruits, while (Suleiman, Wesonga, Mbau, Suleiman, & Ehadi, 2016) estimated proportion of rural homes that derive subsistence and income benefits from forests was about 20 to 25%, which points out the significance of forests as livelihood sources and invariably safe-nets when livelihood sources decimate. Further, extensive study on income which was carried out by the Centre for International Forestry Research (CIFOR) in 2011 found nearly 6000 rural homes in the Congo basin confirmed to derive about one-fifth of their incomes from forest-based sources (Wollenberg et al. 2011).

Based on the aforementioned studies, forests appear to be essential livelihood sources to rural households, where people draw greater share of their income from forests exploitation posing a challenge that leads to forests degradation. However, this studies disregarded communities living far beyond the forests, yet, they too benefit from forest stock flow services, which could further aggravate forests resources degradation. The flow of forests services depend on stability of forest cover which is achieved through conservation by local communities, however disincentives to environmental providers tend to encourage rapid degradation of forests particularly in the developing countries (Makunga & Misano, 2017). Kenya's watershed areas is not exceptional, and it has featured in several environmental reports as one of the highly degraded environmental resources by humans (FRA, 2015). The commonly cited

degrading factors of "water towers" in Kenya are overconsumption of forest products. Social costs from degraded forests among economic units often remain unnoticed by normal markets, which create perverse environmental market (Baujard, 2013). Environmental economists view the perverse market structure of forests service to be associated with non-pricing nature which makes it difficult to assess transaction forum, while the marginal cost among environmental suppliers beyond the first consumer is near or equal to zero (Pearce, 2009) and (Pagiola, 2009).

Therefore, a paradoxical question is, what are the forests attributes and their level of consumption such as fuel wood, food supply, water supply and biodiversity that are derived by upstream and downstream users? Understanding derivation level based on forests attributes among economic units, could reveal trends in forests degrading activities; thus, mitigation measures such as households' income diversification through other professional occupation that are less dependent on forests products to alleviate forests degradation.

Therefore, this paper has three research objectives: (i) To identify consumptive forests products by economic units, (ii) Estimate benefits flow of forests among economic units and (iii) To test relationship of variables that are associated with forests resource consumption by both upstream and downstream.

This study employed consumer theory which postulates the choice of a resource with greater benefits over a resource with low benefits by a consumer to have high and/or maximum utility (Bhahttacharya, 2015). To conceptualise maximization on forests resource among economics units, choice modelling approach derived from Random Utility Model (RUM) which describes consumer behaviour, whereby an individual and/or a household, rates forests attributes by placing the cost when obtaining or procuring such forest products was used (Arabamiry, Rahim, Radam, & Khademfar, 2013). The conceptual framework can be expressed in a function equation as;

$$U_{ij} = f(x_{ij}) \quad (1)$$

Where; U_{ij} is the maximum utility (i) derived from forests attributes (j) by forests consumers, while x_{ij} is the expressed utility (i) from specific forests attributes (j) of fuel wood, food supply, water supply and biodiversity.

RUM is derived from choice contingency modelling where consumer of a resource makes trade-off based on its benefit flows and costs in obtaining it (Howley et al. 2015). In the context to this study, resource consumer is expected to make a choice on a forests resource, which in this case is the forests attributes. This can be expressed in an equation function as;

$$P_i = \text{Prob}\,(U_{ij} > U_{ih});\ j \neq h \text{ and } j > h \quad (2)$$

Where: P_{ij} is the probability of an individual making a choice on a forest attribute; U_{ij} is the individual choice on forest resources with greater benefits; and U_{ih} is the individual choice on forests resources with low benefits flow.

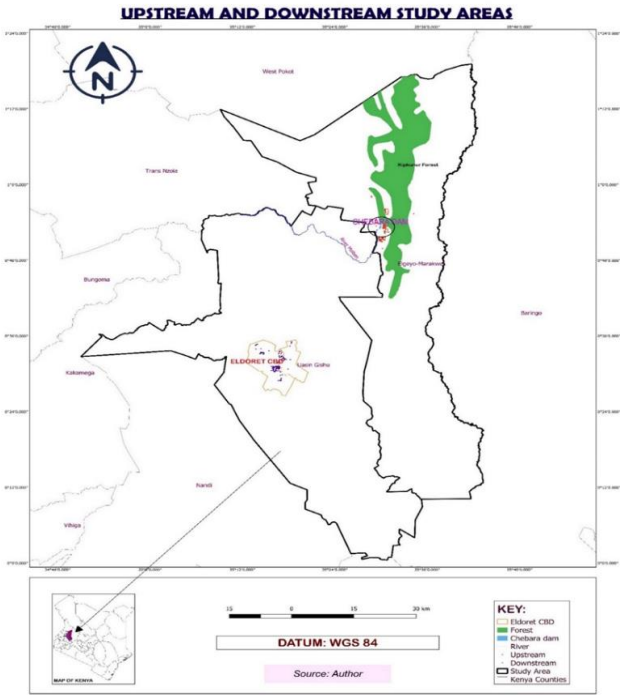


Figure 1: A Map of the Study Area

2. Materials and Methods

2.1 Description of the Study Area.

This study was carried out in two counties namely Uasin Gishu and Elgeyo Marakwet counties as downstream and upstream study areas respectively, between the months of February and April of the year 2019. The geographical location of the downstream study area lies at $0^0$30' North and $0^0$53' North latitudes and $35^0$20' East and $35^0$35' East longitudes, while upstream study area lies at 0^0 24'and 0^0 59' North latitudes and 34^0 07 and 35^0 23 East longitudes, respectively (Figure 1). The topography of the downstream study area is characterised by flat landscape, while upstream exhibit undulating landscape, where downstream is at average of 1200 and upstream at 2000 metres above sea level, respectively. The mean annual rainfall is about 1000mm in both study areas with a pattern showing bimodal type of rainfall, with the long rains starting between the months of March and August, whereas short rains occur in the months of September, October and November. While temperatures range between 14^0C and 24^0C in both study areas owed to its similar weather zones. The dominant economic activity in upstream study area was agricultural venture of crop farming and livestock rearing, while downstream is majorly urban with commercial ventures and entrepreneurship.

2.2 Data Collection Procedure and Samples

Questionnaires were the main data collection tools that were used to obtain descriptive information for households in this study. However, other information was sought from observation, focus group discussion and documented literatures. While administering households' questionnaires, random selection was observed where upstream study area in which households lived within a range of 4 km from the edge of Kipkunur forest were selected, while households who were living within the jurisdiction of Eldoret Municipality was the target group for downstream study area. To achieve systematic random sampling, reference points were established from physical features such as a junction, church gate and/or a school gate was chosen, where the first household at the left hand side was selected as first respondent. The subsequent respondents were selected by following the left hand rule method where every third household was chosen for interview until representative samples needed was exhausted (Hiligsmann, et al., 2013). If the samples remained unexhausted, enumerator could go back to the reference point and take the left path or route and followed similar pattern of choosing every third household for interview with left hand rule being followed.

The sample size required for both upstream and downstream was determined using sample size formula as follows;

$$\mathrm{n} = \frac{\mathrm{NC}^2}{\mathrm{C}^2+(\mathrm{N}-1)\mathrm{e}^2} \text{ (Kothari, 2004)} \qquad (3)$$

Where; n represent sample size, N is population size, C is coefficient of variation at (30%), confidence limit at (95%), while *e* was the standard error at 2%.

Based on (KNBS & SID, 2009) data, the households population for downstream was 9584, while for upstream was 3241 respectively. Therefore, the calculated sample size from the formula was as follows;

Determination of upstream sample size

$$\mathrm{n} = \frac{3241(0.3^2)}{0.3^2 + (3241-1)0.02^2}$$

$$\mathrm{n} = \frac{291.69}{1.386}$$

$$\mathrm{n} = 211$$

Determination of downstream sample size

$$\mathrm{n} = \frac{9584(0.3^2)}{0.3^2 + (9584-1)0.02^2}$$

$$\mathrm{n} = \frac{862.56}{3.9232}$$

$$\mathrm{n} = 220$$

To compensate erroneously entered data and/or information or unclearly explained information in the questionnaires which could invalidate the findings, extra 10% questionnaire was added which made total questionnaires administered for downstream and upstream to be 231 and 224, respectively. To capture respondents consumptive demands in regards to forests benefits, questions in the questionnaires was formulated that depicted economic values from specific forest products. Surrogate and revealed prices from contemporary markets were used to evaluate economic values of forests products consumed by households on both upstream and downstream study area.

In determining economic benefits flow of forest products among economic units, identified forest products i^{th} often consumed by households and quantity of forest products (Q_i) was first sought from respondents. Then, economic value of the identified quantity of forest products often consumed by households was determined by using relative market price (P_i) per unit. Thereafter, aggregate economic value of all identified forest products was determined as described in the following equation.

$$\text{Total Economic Value} = \sum_i^n (P_i\, Q_i)_1 + (P_i\, Q_i)_2 + (P_i\, Q_i)_3 + \cdots (P_i\, Q_i)_n \qquad (4)$$

Further, the mean economic value of the consumed forest products can be restated in an equation as;

$$\text{Mean Economic Value} = \frac{\sum_i^n (P_i\, Q_i)_1 + (P_i\, Q_i)_2 + (P_i\, Q_i)_3 + \cdots (P_i\, Q_i)_n}{n_i} \qquad (5)$$

Where; n_i are the numbers of households consuming respective forest product.

Further, the means of parameters used to describe households' forests benefits and their correlation tests among selected variables, were interpreted and presented in table form and charts to depict households' aspiration in regards to forests use and conservation.

Table 1: Households Socio Economic Characteristics for Upstream and Downstream Study Areas

Variables	Upstream			Downstream		
	Frequency	Mean	S. D.	Frequency	Mean	S.D.
Age	224 (100%)	44.47 Years	12.81	233 (100%)	43.42 Years	10.51
Gender						
Male	103 (46%)	-	-	137 (58.8%)	-	-
Female	121 (54%)	-	-	96 (41.2%)	-	-
Household size	224 (100%)	5.95 Members	2.21	233 (100%)	5.20 Members	1.87
Occupation						
Farmer	195 (87.1%)	-	-	150 (64.4%)	-	-
Business	28 (12.5%)	-	-	52 (22.3%)	-	-
Civil Servant	1 (0.4%)	-	-	29 (12.4%)	-	-
Informal Jobs	0 (0.0%)	-	-	2 (0.9%)	-	-

Source: Author; **Note**: n = 224 (upstream), 231 (downstream) respectively; S.D. = Standard Deviation

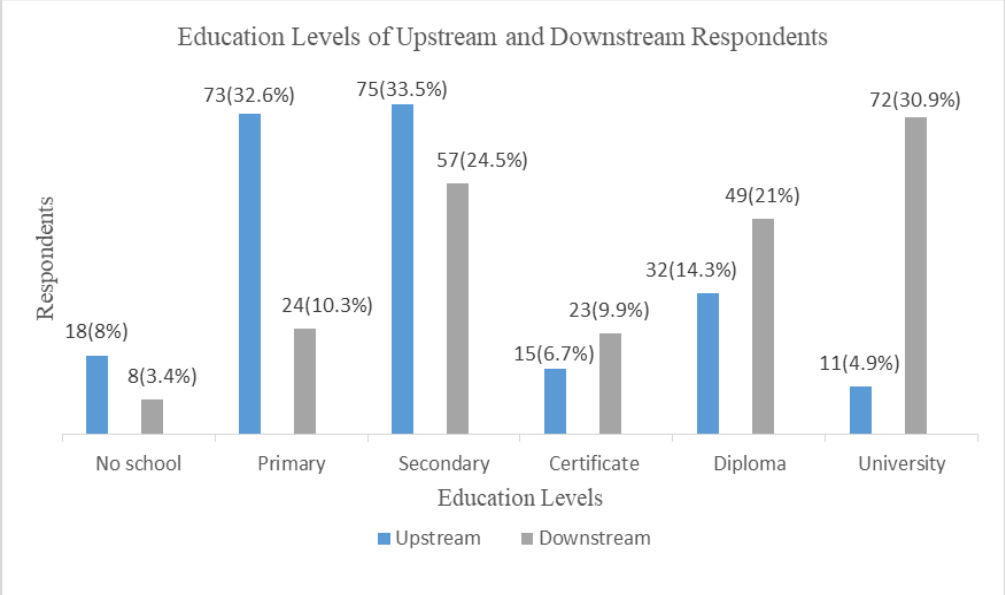
3. Study Results

From the results in Table 1, the construct of age of respondents for upstream and downstream was almost the same at an average of about 44 and 43 years, while households' size was similar of an average of 6 members per households, respectively. Again, there was more female respondents in upstream than in downstream at 121 (54%) and 96 (41.2%), while for downstream more males were found than females at 137 (58.8%) and 103 (46%) respectively. Agricultural ventures was predominantly economic activity for upstream at 195 (87.1%), while proportion of households that engaged in business ventures and formal employments were 28 (12.5%) and 1 (0.4%), respectively. There was no presence of informal jobs in upstream areas. Similarly, downstream areas were seen to derive their livelihoods majorly by engaging in farming activities, business ventures, formal and informal jobs at 150 (64.4%), 52 (22.3%), 29 (12.4%) and 2 (0.9%), respectively.

Further, majority of household heads in upstream had attained basic education at 73 (33%) primary and 75 (34%) secondary education levels, while 15 (6.7%) had certificate, 32 (14.3%) had diploma and 11 (4.9%) had university advanced education levels, respectively. Households heads with no education level at upstream were 18 (8%) with majority found to be elderly persons. Whereas in the downstream, majority of households heads had higher education compared with upstream study area at 72 (30.9%) university, 49 (21%) diploma, 57 (24.5%) secondary, 23 (9.9%) certificate and 24 (10.3%) primary levels, respectively, while 8 (3.4%) had no schooling (Figure 2).

Economic Benefits of Kipkunur Forests Ecosystem

Study results in Table 2 showed identified consumptive forests products. These identified forests products consumed by both upstream and downstream includes fuel



Source: Author

Figure 2: Education Levels of Upstream and downstream Households

wood, wild fruits, herbs, mushrooms, wild vegetables, honey, pasture and water. In overall, upstream was found to benefit more at an average of 190 (84.1%) compared with downstream households at 90 (38.3%). The commonly dependable forest products by upstream and downstream were water, honey and herbs, while pasture benefited upstream users only.

Table 2: Proportion of Households Benefiting from Kipkunur Forest Products

	Upstream		Downstream	
Variables	Freq.	%	Freq.	%
Fuel wood	218	97.3%	44	18.9%
Wild fruits	136	60.7%	22	9.4%
Herbs	220	98.2%	179	76.8%
Mushrooms	145	64.7%	17	7.3%
Wild vegetables	154	68.8%	35	15.0%
Honey	209	93.3%	198	85.0%
Pasture	208	92.9%	0	0.0%
Water	223	99.6%	218	93.6%
Average	**190**	**84.1%**	**90**	**38.3%**

Source: Author; **Note:** n = 224 (upstream), 233 (downstream) respectively; Freq. = Frequency; % = Percentage

Financial and Temporal Constraints in Forests Resource Consumptions

Since forests resources form part of livelihoods among communities, respondents were asked to describe financial and period that prompt them to obtain forest products. The findings showed that majority of upstream respondents at 97 (35.9%) and downstream 62 (27.3%) obtained forests products for their livelihood at all times. Again, results revealed that majority of upstream users at 53 (23.2%) and downstream at 11 (4.9%) rely on forests products as food safe nets. Additionally, upstream users was found to depend on forests products even when they are financially stable at 42 (18.6%) compared with 17 (8.2%) for downstream users. Water was the most consumed components irrespective of financial status by both upstream and downstream users, while pasture was only beneficial to upstream users. Wild fruits, mushrooms and wild vegetables, were obtained by upstream households when under low financial status, however, downstream households were less dependent on such forests products. Further, climate variability influenced consumption of forests products. As such wild fruits 128 (57.1%), Herbs 152 (67.9%), Mushrooms 137 (61.2%) and Honey 145 (64.7%) were found to be obtained seasonally, while Fuel wood 128 (57.1%), Pasture 205 (91.1%) and Water 217 (96.9%) were obtained daily by upstream users. However, there was no much temporal effects in consumption of forests products except Herbs 129 (55.4%) and Honey 128 (54.9%) obtained seasonally and Water 201 (86.3%) obtained on daily basis by downstream users

Correlation Results between Pairs of Variables that Influences Consumptiveness of Forests Products in the Upstream and Downstream Study Areas

Relationship tests results in Table 4 depicted weak correlation values among the selected variables except slightly strong correlated variable of household size to age at 0.550 ($p \leq 0.01$). The construct of distance from the homestead to the edge of the forest showed to be statistically significant and negatively correlated with age and households' size at -0.189 ($p \leq 0.01$) and -0.243 ($p \leq 0.01$), respectively. Again, education level showed to be negatively correlated and statistically significant to household size at -0.278 ($p \leq 0.01$), and age at -0.305 ($p \leq 0.01$), and positively statistically significant and correlated to occupation at 0.319 ($p \leq 0.01$). Additionally, forest incomes showed to be positively statistically significant to household size at 0.146 ($p \leq 0.05$) and negatively significant to household head occupation at -0.135 ($p \leq 0.05$). Further, the results showed that household income was statistically significant and positively correlated with distance to the edge of the forest at 0.181 ($p \leq 0.01$), households head occupation at 0.256 ($p \leq 0.01$) and level of education at 0.289 ($p \leq 0.01$), respectively. However, existence of small correlation coefficient values among the

Table 3: Descriptive Statistics Depicting Households Consumptiveness of Forests Products Under Different Financial Levels

Variables	Upstream			Downstream		
	Financially Low	Financially Stable	At All Times	Financially Low	Financially Stable	At All Times
Fuel wood	45 (20.1%)	48 (21.4%)	123 (54.0%)	11 (4.7%)	11 (4.7%)	22 (9.4%)
Wild fruits	105 (46.9%)	29 (12.9%)	7 (3.1%)	8 (3.4%)	3 (1.3%)	12 (5.2%)
Herbs	25 (11.2%)	52 (23.2%)	144 (64.3%)	24 (10.3%)	42 (18.0%)	121 (51.9%)
Mushrooms	104 (46.4%)	40 (17.9%)	5 (2.2%)	12 (5.2%)	2 (9.0%)	4 (7.7%)
Wild vegetables	99 (44.2%)	24 (10.7%)	32 (14.3%)	7 (3.0%)	4 (1.7%)	23 (9.9%)
Honey	29 (12.9%)	138 (61.6%)	43 (19.2%)	20 (8.6%)	69 (29.6%)	110 (47.2%)
Pasture	6 (2.7%)	3 (1.3%)	202 (90.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Water	3 (1.3%)	1 (0.04%)	219 (97.8%)	9 (3.9%)	3 (1.3%)	203 (87.1%)
Average	**53 (23.2%)**	**42 (18.6%)**	**97 (35.9%)**	**11 (4.9%)**	**17 (8.2%)**	**62 (27.3%)**

Source: Author; **Note:** n = 224 (upstream), 233 (downstream) respectively

Table 4: Correlation Matrix between pairs of Variables Associated with Upstream Consumption of Forests products

Variables	LnAge	LnHousehold size	LnDistance	LnOccupation	LnEducation level	LnForest income	LnHousehold Income
LnAge	1						
LnHousehold size	0.550** (0.000)	1					
LnDistance	-0.189** (0.005)	-0.243** (0.000)	1				
LnOccupation	-0.040 (0.547)	-0.081 (0.228)	0.015 (0.822)	1			
LnEducation level	-0.305** (0.000)	-0.278** (0.000)	0.064 (0.345)	0.319** (0.000)	1		
LnForest income	-0.108 (0.106)	0.146* (0.029)	-0.078 (0.248)	-0.135* (0.044)	-0.037 (0.584)	1	
LnHousehold Income	-0.071 (0.292)	-0.032 (0.639)	0.181** (0.007)	0.256** (0.000)	0.289** (0.000)	0.003 (0.962)	1

Source: Author. **Note:** ** = Correlation is significant at the 0.01 level (2-tailed); * = Correlation is significant at the 0.05 level (2-tailed).

selected variables suggest minimal collinearity. While on downstream study area (Table 5), the correlation tests which was done among the influencing variables of households' consumptiveness of forests products showed age to be significantly and positively correlated with households' size at 0.466 ($p \leq 0.01$). The variable of education level showed to be statistically significant to age and household head occupation, however, age was negatively correlated, while occupation was positively correlated at -0.137 ($p \leq 0.05$) and 0.216 ($p \leq 0.01$) respectively.

Again, the derived forests income by downstream households showed to be statistically significant and negatively correlated to occupation at -0.193 ($p \leq 0.01$). Further, households income showed to be significant to age, households size, occupation, education level and households income, however, it was positively correlated to age at 0.204 ($p \leq 0.01$), households size at 0.195 ($p \leq 0.01$), education level at 0.185 ($p \leq 0.01$) and derived income from forests at 0.173 ($p \leq 0.01$) and negatively correlated to occupation at -0.140 ($p \leq 0.05$), respectively.

4. Discussions

Existences of more female than male in upstream study area depicts African norm where households' activities are performed based on gender where females often do domestic chores, while men perform external households' activities. This study findings was in tandem with the findings of (Maruzani, 2014). The fairly elderly households as depicted by the study results shows the level of culture transfer and understandings on the utilisation of forest resources and conservation. Engagement of agricultural venture as livelihood source as depicted by results, raises the probability of households to degrade natural resources if sustainability is disregarded.

Table 5: Correlation Matrix between pairs of Variables Associated with Downstream Consumption of Forests products

Variable	LnAge	LnHousehold size	LnDistance	LnOccupation	LnEducation Level	LnForest Income	LnHousehold Income
LnAge	1						
LnHousehold size	0.466** (0.000)	1					
LnDistance	-0.120 (0.861)	0.036 (0.585)	1				
LnOccupation	0.014 (0.835)	-0.027) (0.687)	-0.073 (0.270)	1			
LnEducation Level	-0.137* (0.037)	-0.107 (0.104)	0.007 (0.914)	0.216** (0.001)	1		
LnForest Income	-0.041 (0.539)	0.069 (0.303)	-0.069 (0.304)	-0.193** (0.004)	-0.069 (0.300)	1	
LnHousehold Income	0.204** (0.002)	0.195** (0.003)	0.090 (0.173)	-0.140* (0.033)	0.185 (0.005)	0.173** (0.009)	1

Source: Author. **Note:** **Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed).

Therefore, it points out the need for mitigation strategies that annihilate unsustainable agricultural practices that abets degradation. However, existences of low skilled population as reflected by results with majority had basic education, raises fundamental question on the entrepreneurial skills among population at upstream which are seen as strategies of cushioning forests dependency for livelihood.

The fact that studies by (Miura, et al., 2015) and (Kohl, et al., 2015) who found forests resources to be dependable by communities especially to those who live at adjacent to the forests, is supported by the findings of this study. However, distance decay effect from the study findings was a predominant factor; that's the closer the community to the forest(s), the greater benefits they derive from forests and vice versa. Therefore, this preposition justifies the need to incentivize the upstream users to reduce overdependence of forests resources as a way of guaranteeing continuous stock flow of forests products among economic units. Study by (Porras, 2012) pointed out the need to identify key stakeholders in terms of benefit flow levels to facilitate the formulation of rewards redistribution among resources generators and consumers to reflect Kaldor-Hicks compensating variation. This findings affirms the need for downstream users to compensate the upstream resources providers for their foregone utilities that are derived from forests.

According to (Babulo, et al., 2009) and (Chakravarty, Ghosh, Suresh, Dey, & Shukla, 2012), they found income to influence the consumptiveness of forests resources, hence a critical variable that determines forests resource protection and conservation. Studies by (Sumukwo, Wario, Kiptui, Cheserek, & Kipkoech, 2013) and (Wunder, Borner, Shively, & Wyman, 2014) found that forests act as insurance or food security safe nets for adjacent communities when households are faced by financial shocks therefore supporting the findings of this study. That's price demand-pull due to food scarcity on basic food are often caused by climatic variability forces making vulnerable households to resort in obtaining alternative food supply that are freely obtained from forests resources such as wild vegetables, wild fruits and mushroom. Other forests products such as herbs, wood fuel, honey, pasture and water which showed to be consumed irrespective of low financial status from the study results, suggests to be basic consumptive forests products to upstream households. For instance, honey and herbs serve as alternatives for food and medication, while wild vegetables, wild fruits and mushrooms act as food and essential nutrition to households as asserted by focus group discussion.

While, for downstream forests resource users, distance decay influences households' dependency on forests products. Evidence from study results revealed that fuel wood, wild fruits, mushrooms, wild vegetables and pasture was consumed in small quantities or none as distance increase from the sources of such forests products. Since most forests product are available on particular seasons, this causes most of the forests products such as wild fruits, mushrooms, wild vegetables and honey to be obtained at specific seasons as depicted by study results. Notably, nearness of forests to upstream users allows them to graze their livestock in the forest and obtain fuelwood daily unlike downstream users. Water as the basic commodity in households featured to be the most obtained forest product on daily basis by both upstream and downstream users, pointing out the need for protection of watershed areas for continuous water supply. Apart from proximity of forests to upstream community, direct consumption with minimal or no restriction could reflect satiation effects in forests consumption to upstream users, while the effect of income loss due to purchasing parity which reflects non satiations on forests product could be a constraining factor to downstream users. Therefore, free riding effects on a forests resources could be linked to over exploitation and degradation, pointing out the need of developing policy that restrict free riding on resources or incentivize resources provider to prudently adopt conservation efforts for sustainability. Again, presence of alternative sources of energy such as electricity, liquefied petroleum gas, bio gas, kerosene and charcoal from local vendors at downstream could contribute to less consumption of fuel wood.

Study results from correlation matrix revealed mixed relations of either positive or negative association with forests resources consumption from the selected pairs of variables in both study areas. The statistical significance and negative correlation of forests benefits to occupation of households in both upstream and downstream study areas, imply that households in both study areas rely on forests resources for their livelihood, however, their reliance tend to reduce as occupation exists either from formal or informal jobs. This finding was in agreement with the study findings of (Angelsen, et al., 2014) who found forests resources as sources of livelihood to low income households. Again, only households' size in upstream study area showed to be a critical variable of concern based on its statistical significance in deriving forests benefits, while positive correlation suggests that increased household's consumptive demands as a result of large family size makes them to rely on forests products as sources of livelihood. This finding also was in agreement with study results of (Newton, Miller, Augustine, Byenkya, & Agrawal, 2016) and (Munarura, Backman,

Hallo, Powell, & Sabuhoro, 2018) that large household size in the upstream access forest resources to obtain extra income to support their livelihood.

The decisive variable based on significance between households' size and age and its positive relationship in both upstream and downstream suggests that elderly household heads were likely to have large household size, depicting cause of high consumptive demands of forests products by the two variables. The negative association between homestead distance to the edge of the forests and age, only in the upstream, suggests that elderly persons were less likely to go to the forests in search of consumptive forests products. However, the inverse correlation between the variable of distance and households' size, which showed to be a critical in upstream study area only, was difficult to interpret and contradicting with theoretical concepts of resources demand, hence formed part of the limitation in this study. The inverse relationship between education level and age in both upstream and downstream implies that households' heads with low level of education were elderly ones. While negative correlation exhibited by study results of upstream only between education level and family size imply that small family size in upstream study area had relatively high chances of accessing formal education to the higher levels. Further, the positive relationship between education level and occupation in both upstream and downstream study areas suggests that the higher the educated households' head tend to engage in entrepreneurial activities; hence, widen their sources of income.

Correlating households' income with occupation could reveal income stability, based on the study results but from upstream and downstream it showed diverse relationship. The positive relationship between household income and occupation in upstream study area could depict income instability whereby households are forced to engage in other livelihoods sources of income including forests products, while inverse relationship at downstream areas could reveal income stability even when households engage in less income generating activities; that's households heads at downstream areas could be engaging in high income jobs due to their professionalism as experts or specialization in income generating activities. Again, findings of upstream study area reveals that, irrespective of the distances to the forests, households' occupation or level of education, rural homes rely on forests products as part of their livelihood sources unlike downstream study area Again, variable of households' income showed to be significant and positively correlated to homestead distance to the edge of the forests, households head occupation and education level. This study results is in tandem with the findings of (Gross-Camp, 2017) which found forests as a livelihood sources.

In addition, the negative correlation of education level to age and households' size, can be deduced that, low education level among elderly population and big family size which increases forests products demands can cause overconsumption and thus degradation if scientific advances acquired from formal education is disregarded. The positive correlation to occupation could reveal income diversification through employment as an influencing determinant in forests resource consumption. However, the significance and positive correlation of age and family size on households income at downstream study area, could suggest that the elderly households heads and the larger the family size is linked to high income either through income saving and investment, while larger family size could provide family labour on agricultural activities unlike in upstream study areas. The significance of households' income and its positive correlation to forests products benefits at downstream study area, could be linked to the ability to buy forests products by households as a way of improving nutrition's or alternative medical remedies.

5. Conclusion

From the study results, forests commodities that were found to be consumed in-situ and ex-situ includes; fuel wood, mushrooms, wild fruits, wild vegetables, honey, herbs, pasture for domestic animals, and water. Distance decay was a predominant factor that affected the consumption of forest products among economic units. Further, forest products such as mushroom, wild fruits, honey and herbs was found to act as food security safe nets and as medicinal remedy majorly in upstream, while downstream was found to seldom rely on such forests products. Further, the results depicted marginal variation in consumption of forests commodities. These variance explains in-equilibrium in resources redistribution among economic units; hence, non-conformity to Kaldor-Hicks compensation tests. Therefore, this calls for the policy formulation that could bridge these resource use variation as depicted by the study results.

6. Recommendation

Reliance of agriculture by upstream households as the mainstay income source coupled with low level of education could increase the propensity to degrade environments. Therefore, it calls for policy intervention that enhance access to formal education especially at upstream study area in order to impart scientific knowledge on resource protection and conservation. Again, access to education could increase entrepreneurial skills; hence, increasing the chances of income

diversification through self-employment. Again, existence of critical variable such as inverse relationship of households' size and distance to the edge of the forests which was difficult to interpret and formed part of the limitation in this study based on its contradiction with the theoretical concepts on resources use informs the need for further investigation.

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